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MICRO  
SOFT





## **We set the standard in micro software**

At Microsoft, we produce high-quality, concise software for today's micro-processors and provide complete support to every customer.

Microsoft's microcomputer software is the most widely accepted software in the OEM market, whether it is supplied off the shelf or in customized versions to companies with unique software and hardware requirements. This ability to customize large systems software packages has proven very valuable to Microsoft's OEM customers.

As an example, Microsoft delivered to NCR Corporation a complete cassette-based BASIC tailored for use with the NCR 7200 series product line. Ten statements and eight functions were added to BASIC to allow easy creation and modification of cassette files. Special interfaces were added to support NCR's wide line of peripherals. Features that NCR felt were unnecessary for their intended market were removed from BASIC to give users more memory for program storage.

Another example: Microsoft supplied both 8080-based FORTRAN and Disk BASIC to Applied Data Systems for use with their Systems 50 and 70. Additional capabilities were written into BASIC to support ADDS' unique keyboard and to provide fast cursor editing. Because ADDS saw a market potential for BASIC and FORTRAN along with their existing data entry software, ADDS\* PLUS, these languages were enhanced to allow reading and modification of IBM 3740 format floppy disk files.

Custom software has also been provided to Commodore for use on the PET computer, to Pertec/MITS for use on the Altair product line and to Tandy Corporation (Radio Shack) for use on the TRS-80. Other OEM customers include: General Electric, Ontel, Imsai, Cromemco, Billings Computer, Data Terminals and Communications, Sykes Datatronics, Apple Computer, Ohio Scientific, SORD and Warner and Swasey.

Microsoft was established in November, 1974 by its two principal partners, Mr. William H. Gates and Mr. Paul G. Allen. Their meticulous approach to the development of microprocessor software has allowed the production of large amounts of bug-free, well-designed code in a minimum amount of time. Currently available: BASIC interpreters for the 8080, 6800 and 6502 micro-processors, a FORTRAN compiler, assembler, loader and runtime library package for the 8080 and Z-80 microprocessors and a FOCAL interpreter for the 6800 and 6502 microprocessors. Available in early 1978: An APL interpreter and a COBOL compiler, both for the 8080 and Z-80.

Microsoft also provides consulting on the design and implementation of microprocessor software. Experts in the 8080, Z-80, 6502, 6800, 9900, 8086, 6809 and Z8000 processors are available on a long or short term consultation basis. Microsoft's extensive experience with all the major microprocessors makes us uniquely qualified to help determine their most effective use.

## Microsoft BASIC

### Overview

Microsoft BASIC is an extensive implementation of BASIC for 8080 and Z-80 microprocessors. Its features are comparable to those of BASICs found on minicomputers and large mainframes.

### Current Versions of Microsoft BASIC

Microsoft BASIC is currently in its fourth major release (4.3). Each release consists of four different versions of BASIC:

1. 4K version: Stripped down version to run in minimum memory. Includes direct statement execution, dynamic dimensioning of arrays and multiple statements per line.
2. 8K version: Standard version. Includes string manipulation and multiple dimension arrays. (Also available for 6800 and 650x series MPUs.)
3. Extended version: Requires 16K of memory. Features include integers, double precision, EDIT, AUTO, RENUM, PRINT USING, etc.
4. Disk version: Requires 20K of memory. All features of Extended version plus random and sequential file access on floppy disk.

The different versions are generated from the same source files using conditional assembly switches. Each version is upward compatible with larger versions.

In our comparisons with other BASICs, we will examine only the Disk version. The features of the other versions may be obtained from the Microsoft BASIC manual.

## Features

Microsoft BASIC, widely known as Altair BASIC, is the most extensive 8080/Z-80 BASIC available. It contains many unique features rarely found in other BASICs:

1. Direct access to CPU I/O ports (INP, OUT)
2. Ability to read or write any memory location (PEEK, POKE)
3. Matrices with up to 255 dimensions
4. Dynamic allocation and deallocation of matrices at execution time (DIM A [I,J], ERASE A)
5. IF...THEN...ELSE and nested IF...THEN...ELSE
6. Direct (immediate) execution of statements
7. Error trapping
8. Four variable types: Integer, String, Single Precision Floating Point (7-digits) and Double Precision Floating Point (16-digits)
9. Full PRINT USING for formatted output (includes asterisk fill, floating \$ sign, scientific notation, trailing sign, comma insertion)
10. Extensive program editing facilities via EDIT line command, RENUM, AUTO, etc.
11. Trace facilities (TRON, TROFF)
12. Ability to call up to 10 assembly language sub-routines
13. Boolean operators OR, AND, NOT, XOR, EQV, IMP
14. BASIC can be placed on ROM

Microsoft Disk BASIC also supports files on multiple floppy disks:

1. Sequential files with variable length records
2. Random files (record I/O)
3. Complete set of file manipulation statements: OPEN, CLOSE, GET, PUT, KILL, NAME, etc.
4. Up to 255 files per floppy disk
5. Runs standalone or under CP/M or ISIS-II operating systems

Commands:

AUTO	CLEAR	CONT	DELETE	EDIT
FILES	LIST	LLIST	LOAD	MERGE
NEW	NULL	RENUM	RESET	RUN
SAVE	SYSTEM	TRON	TROFF	WIDTH

Program Statements:

DEFNx	DEFDBL	DEFINT	DEFSNG	DEFSTR
DIM	END	ERASE	ERROR	FOR
GOSUB	GOTO	IF...THEN [ELSE]	LET	NEXT
ON...ERROR	ON...GOSUB	ON...GOTO	OUT	POKE
REM	RESUME	RETURN	STOP	SWAP
WAIT				

Input/Output Statements:

CLOSE	DATA	FIELD	GET	INPUT
KILL	LINEINPUT	LSET	NAME	OPEN
PRINT	PUT	READ	RESTORE	RSET

Operators:

=	-	+	*	/
↑	\	MOD	NOT	AND
OR	XOR	IMP	EQV	<
>	<=	>=	<>	

Arithmetic Functions:

ABS	ATN	CDBL	CINT	COS
CSNG	ERL	ERR	EXP	FRE
INP	INT	LOG	LPOS	PEEK
POS	RND	SGN	SIN	SPC
SQR	TAB	USRn	VARPTR	

String Functions:

ASC	CHR\$	FRE	HEX\$	INSTR
LEFT\$	LEN	MID\$	OCT\$	RIGHT\$
SPACE\$	STRING\$	STR\$	VAL	

Input/Output Functions:

CVD	CVI	CVS	EOF	LOC
LOF	MKD\$	MKI\$	MKS\$	

	<u>Microsoft BASIC</u>	<u>DEC RSTS BASIC</u>	<u>DEC PDP-10 BASIC</u>	<u>IBM 5100 BASIC</u>
CPU	8080 or Z-80	PDP-11/50, other 11	KA (or KI or KL) -10	370 compatible
Size (bytes)	19.5K	28K	67K	48K
Statements	41	40	30	32
Variable types	Integer, String, Real, Double Real	Integer, String, Real	String, Real	String, Real
Numeric Functions	21	13	21	25
String Functions	13	13	9	1
Direct Statements	Yes	Most	No	No
Mass Storage	Floppy Disk, Cassette	Large Disks	Large Disks	3M Tape Cartridge
Implementation	Interpreter	Interpreter+PseudoCode	Compiler	Interpreter
Maximum Program Size	44K	32K	.5 Megabytes	32K
Floating Point Accuracy (Decimal Digits)	7.1 and 16.8	7.1 or 16.8	8.1	13
Time to Execute 10000 Iteration FOR Loop	15 seconds	4 seconds	.03 second	16.4 seconds
Time for 10000 Iteration Integer FOR Loop	7 seconds	3.6 seconds	N/A	N/A
Multi Line Functions	No	Yes	Yes	Yes
Boolean Operators	Yes	Yes	No	No
IF...THEN...ELSE	Yes	Yes	No	No
Multi Statement Lines	Yes	Yes	No	No
PRINT USING	Yes	Yes	Yes	Yes
EDIT line	Yes	No	No	No
RENUMBER	Yes	No	Yes	Yes
Automatic Line Insert	Yes	No	No	Yes
Cost of minimum configuration (approx)	\$6000	over \$30,000	over \$200,000	\$8000
Unique Features	Long Variable Names, IMP, XOR, EQV, MOD, Substring Assignment, Hex, Octal constants, PEEK, POKE, INP, OUT	Statement Modifiers, IMP, XOR, EQV, MOD, Virtual Matrices	CHANGE Multiple LET	Special Interrupt Keys

TABLE I
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## Comparison of BASICs

An examination of Table I shows that Microsoft BASIC is comparable to RSTS BASIC and generally superior to PDP-10 BASIC and 5100 BASIC in terms of statements, functions and editing facilities. Microsoft BASIC is the faster microprocessor BASIC of the two examined and is close to RSTS BASIC in execution speed (between two and five times slower). This is impressive considering the CPU is a two microsecond LSI chip. (Faster versions of the 8080 CPU are available.) For an in-depth comparison of microprocessor BASIC execution speeds, see "BASIC Timing Comparisons," Kilobaud, October, 1977. This comparison features Microsoft's 8K 6502 BASIC (OSI BASIC and PET BASIC) as well as Microsoft's 8K 6800 BASIC (Altair 680 BASIC) and 8080 8K Extended and Disk BASICs (Altair BASIC).

Microsoft BASIC also uses less memory than any other BASIC examined. For fairly large system programs, microprocessors are proving to be as good or better than minis or large mainframes in terms of efficiency of memory use.

## Support

Microsoft BASIC users will receive quick turnaround on bug fixes, and new versions of Microsoft BASIC will be documented and distributed in an expedient manner.

Microsoft's complete product line includes FOCAL for the 6502 and 6800, FORTRAN for the 8080 and Z-80 and development software for all of these microprocessors.

## Pricing

### Single Copies

All versions of Microsoft's 8080/Z-80/8085 BASIC are available off the shelf. Each user must sign a non-disclosure agreement before the copy of BASIC will be shipped by Microsoft. Updates for enhanced versions will cost between \$25 and \$75, depending on the extent of the enhancements. Backup copies of BASIC may be purchased for \$25. A BASIC manual will be included with every BASIC shipped except for backup copies.

In the memory requirements given below, only the size of BASIC itself is given.

<u>Version</u>	<u>System</u>	<u>Price</u>	<u>Supplied on</u>
8K	Intellec	\$150	hex paper tape
8K	MDS	\$150	hex paper tape
8K	SBC 80/10	\$150	hex paper tape
8K	SBC 80/20	\$150	hex paper tape
8K	PCS-80	\$150	hex paper tape
Extended (15K)	Intellec	\$250	hex paper tape
Extended (15K)	MDS	\$250	hex paper tape
Extended (15K)	SBC 80/10	\$250	hex paper tape
Extended (15K)	SBC 80/20	\$250	hex paper tape
Extended (15K)	PCS-80	\$250	hex paper tape

Hex paper tapes use standard Intel format.

Disk (17K)	CP/M	\$350	full size single density diskette
Disk (17K)	ISIS-II	\$350	full size single and double density diskette

#### Note

Microsoft's 8K 6502 BASIC may be obtained from:

Johnson Computer  
P.O. Box 523  
Medina, Ohio 44256

#### Dealer Purchases

Dealers may purchase CP/M or ISIS-II BASIC from Microsoft for \$250 per copy if they purchase at least four copies and sign a standard dealer agreement.

#### OEM Licensing

Both flat fee and royalty licenses may be obtained from Microsoft for any of the above BASICS or for custom versions. For more information on OEM licenses, please contact:

Paul G. Allen  
Vice President, Microsoft  
300 San Mateo NE, Suite 819  
Albuquerque, NM 87108  
505-262-1486



## FORTRAN-80

### Overview

Microsoft's FORTRAN-80 package provides new capabilities for users of 8080 and Z-80 based microcomputer systems. FORTRAN-80 is comparable to FORTRAN compilers on large mainframes and minicomputers. All of ANSI Standard FORTRAN X3.9-1966 is included except the COMPLEX data type. -Therefore, users may take advantage of the many applications programs already written in FORTRAN.

Versions of FORTRAN-80 for the CP/M, ISIS-II, DTC Microfile and MITS DOS floppy disk operating systems are available off the shelf. Other versions will be prepared based upon user demand.

### Relocatable Code and Library Features

FORTRAN-80 is unique in that it provides a microprocessor FORTRAN and assembly language development package that generates relocatable object modules. This means that only the subroutines and system routines required to run FORTRAN-80 programs are loaded before execution. Subroutines can be placed in a system library so that users develop a common set of subroutines that are used in their programs. Also, if only one module of a program is changed, it is necessary to re-compile only that module.

The standard library of subroutines supplied with FORTRAN-80 includes:

ABS	IABS	DABS	AINT
INT	IDINT	AMOD	MOD
AMAX0	AMAX1	MAX0	MAX1
DMAX1	AMINO	AMIN1	MINO
MIN1	DMIN1	FLOAT	IFIX
SIGN	ISIGN	DSIGN	DIM
IDIM	SNGL	DBLE	EXP
DEXP	ALOG	DLOG	ALOG10
DLOG10	SIN	DSIN	COS
DCOS	TANH	SQRT	DSQRT
ATAN	DATAN	ATAN2	DATAN2
DMOD	PEEK	POKE	INP
OUT			

The library also contains routines for 32-bit and 64-bit floating point addition, subtraction, multiplication, division, etc. These routines are among the fastest available for performing these functions on the 8080.

## Enhancements

The FORTRAN-80 compiler has a number of enhancements of the ANSI Standard:

1. LOGICAL variables which can be used as integer quantities in the range +127 to -128.
2. LOGICAL DO loops for tighter, faster execution of small valued integer loops.
3. Mixed mode arithmetic.
4. Hexadecimal constants.
5. Literals and Holleriths allowed in expressions.
6. Logical operations on integer data. .AND., .OR., .NOT., .XOR. can be used for 16-bit or 8-bit Boolean operations.
7. READ/WRITE End of File or Error Condition transfer. END=n and ERR=n (where n is the statement number) can be included in READ or WRITE statements to transfer control to the specified statement on detection of an error or end of file condition.
8. ENCODE/DECODE for FORMAT operations to memory.

## FORTRAN-80 Compiler Characteristics

The FORTRAN-80 compiler can compile several hundred statements per minute in a single pass and needs less than 24K bytes of memory to compile most programs. Any extra available memory will be used by the compiler for extended optimizations.

In spite of its small size, the FORTRAN-80 compiler optimizes the generated object code in several ways:

1. Common subexpression elimination. Common subexpressions are evaluated once, and the value is substituted in later occurrences of the subexpression.
2. Peephole Optimization. Small sections of code are replaced by more compact, faster code in special cases. Example: `I=I+1` uses an `INX H` instruction instead of a `DAD`.

3. Constant folding. Integer constant expressions are evaluated at compile time.
4. Branch Optimizations. The number of conditional jumps in arithmetic and logical IFs is minimized.

Long descriptive error messages are another feature of the compiler. For instance:

? Statement unrecognizable

is printed if the compiler scans a statement that is not an assignment or other FORTRAN statement. The last twenty characters scanned before the error is detected are also printed.

The compiler generates a fully symbolic listing of the machine language being generated. At the end of the listing, the compiler produces an error summary and tables showing the addresses assigned to labels, variables and constants.

#### Assembler, Linker and Library Manager

A relocating assembler (MACRO-80), relocating linking loader (LINK-80) and a library manager (LIB-80) are included in the FORTRAN-80 package.

The relocating assembler is compatible with INTEL's assembler, except MACRO capability is not provided. The assembler uses approximately 7K bytes of memory.

LINK-80, the relocating loader, resolves internal and external references between the object modules loaded. LINK-80 also performs library searches for system subroutines and generates a load map of memory showing the locations of the main program, subroutines and COMMON areas. LINK-80 requires approximately 4K bytes of memory.

LIB-80, the library manager, allows the user to customize libraries of object modules. LIB-80 can be used to insert, replace or delete object modules within a library, or create a new library from scratch. LIB-80 commands can also list the modules in the library and the symbol definitions they contain. LIB-80 requires approximately 4K of memory and uses the rest of memory as a buffer for its editing operations.

#### Custom I/O Drivers

Users may write non-standard I/O drivers for each Logical Unit Number, making the task of interfacing non-standard devices to FORTRAN programs a straightforward one.

### Future Extensions

During the first quarter of 1978 MACRO capability will be added to the assembler, and LINK-80 will be modified to handle overlays.

### Support

FORTRAN-80 users will receive quick turnaround on bug fixes, and new versions of FORTRAN-80 will be documented and distributed in an expedient manner.

### Other Products

Microsoft's complete product line includes FOCAL for the 6502 and 6800, BASIC for the 6502 and 6800, and Altair (8080) BASIC. In addition, Microsoft has development software that runs on the DEC-10 for all of these microprocessors.

### Pricing

#### Single Copy Prices:

FORTRAN-80 system (including documentation)	\$500.00
FORTRAN-80, MACRO-80, LINK-80, LIB-80 manuals and system users guide	\$ 20.00

OEM and dealer agreements are available upon request.

For more information contact:

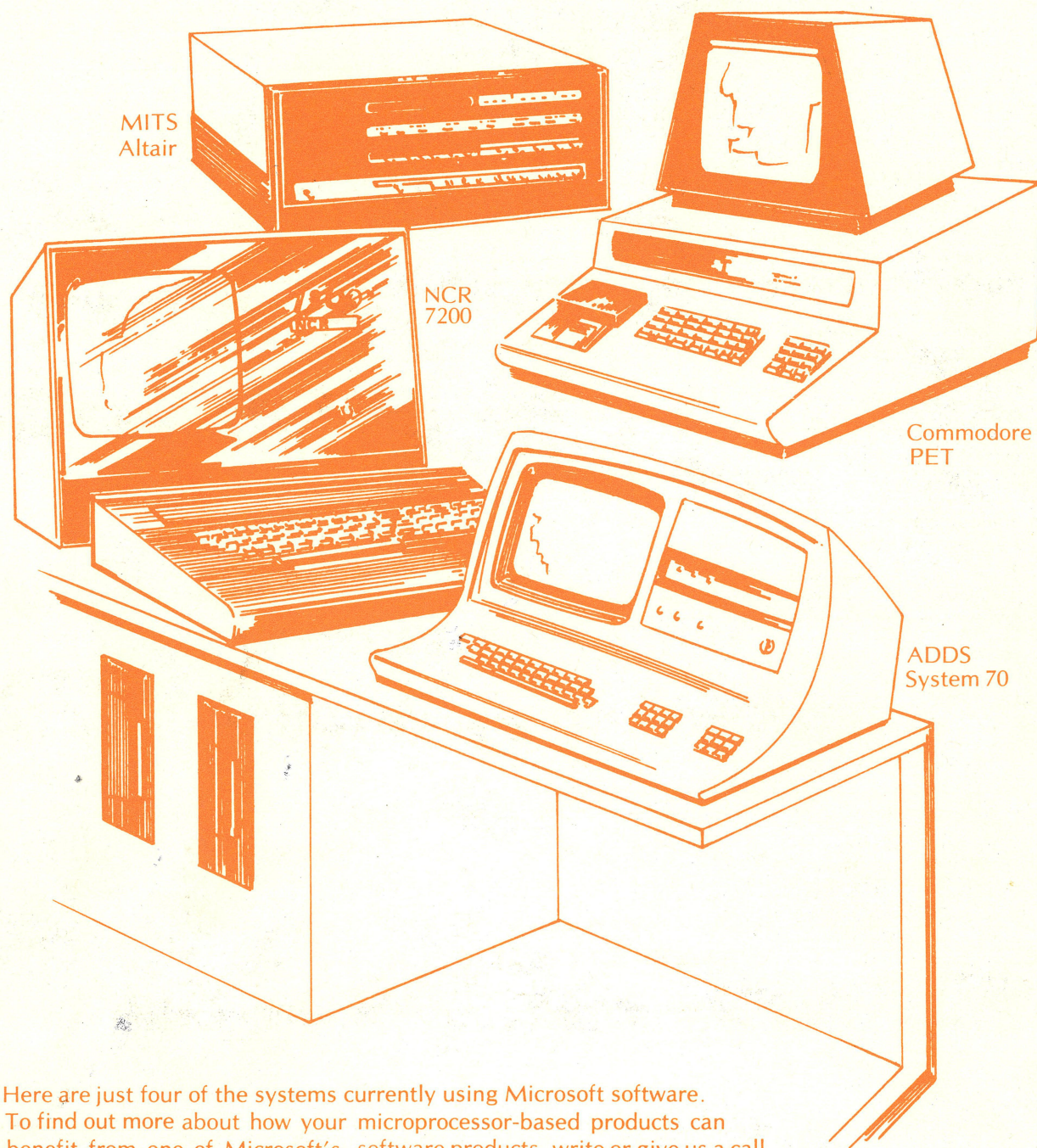
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Here are just four of the systems currently using Microsoft software.  
To find out more about how your microprocessor-based products can  
benefit from one of Microsoft's software products, write or give us a call.

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